Republic of Tunisia

FY2023 Ex-Post Evaluation Report of

Japanese ODA Loan "Borj Cedria Science and Technology Park Development Project"

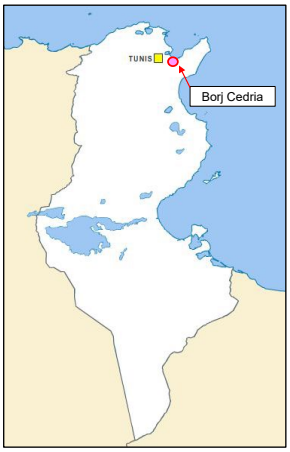
External Evaluator: Keishi Miyazaki, OPMAC Corporation

0. Summary

The objective of this project was to foster science and technology-related human resources and improve the research and development (R&D) capacities by supporting the higher education and R&D functions of the Borj Cedria Science and Technology Park near Tunis, thereby contributing to human resource development to strengthen the country's industrial competitiveness. The project was consistent with the development plan and development needs of Tunisia at the time of the appraisal and at the time of the ex-post evaluation. Consistency with Japan's assistance policy was also confirmed. There was also more-than-initially expected collaboration with other JICA projects, as well as with Japanese universities, such as Tsukuba University. Therefore, the relevance and coherence of the project are very high. Although there were some revisions to the project scope and additional outputs, the outputs were generally implemented as planned. Although the project cost was within the plan, the project period significantly exceeded the plan. Therefore, the efficiency of the project is moderately low. Regarding the quantitative effect (the operational and effect indicator), the targets were mostly achieved except for the number of students, number of students who obtained degrees and the number of teachers of some higher education institutions. As regards the development of human resources in science and technology, the improvement of R&D capacity and the creation of a foundation for the promotion of R&D in Tunisia, the effects have been observed as planned. A positive impact on efficient R&D through industry-government-academia collaboration was also recognized, however, the impact on strengthening international competitiveness in science, technology and industry for the medium to long term was limited. No negative impacts on the natural environment caused by the project were identified, and there was no resettlement associated with the land acquisition. The high proportion of women among students at the target higher education institutions and researchers at the research centers confirms that women have been given adequate opportunities to participate in science education and R&D. From the above, it can be seen that the project has mostly achieved its objectives. Therefore, the effectiveness and impacts of the project are high. Slight issues were observed in the technical and financial, and preventative measures to risks, but there are good prospects for improvement/resolution. Therefore, the sustainability of the project effects is high.

In light of the above, this project is evaluated to be highly satisfactory.

1. Project Description



Project Location
(Source: Management Company of the Technopole de Borj Cedria)

Research equipment procured by the project
(Biotechnology Research Center)
(Source: Evaluator)

1.1 Background

Since the 1990s, the Tunisian economy had been diversifying through the promotion of textile and electronics-related export industries, and tourism, in order to break away from the traditional economic structure which was dependent on agriculture and oil exports. As Tunisia was preparing for the complete elimination of tariffs in 2008 based on the partnership agreement signed with the European Union in 1995, and as competition with Central and Eastern European countries in terms of the inflow of foreign products and direct investment was expected to continue to intensify, strengthening the competitiveness and diversification of industry through R&D, etc. had become an urgent policy issue. In addition, the unemployment rate in the country was high, at approximately 14% (2003), and securing employment for young people under 25 years of age, accounting for approximately half of the unemployed, was a particularly important issue.

The Tenth Five-Year Plan (2002-2006) identified the creation of employment, the strengthening of human resources development and the enhancement of industrial competitiveness as key issues, and in the field of higher education, the plan stated that, in addition to responding to the increase in the number of students, the top priority would be to ensure the employability of graduates and to promote the development of human resources that meet the needs of industry and have high potential for employment and entrepreneurship. In the field of scientific research, the plan also stated the need to strengthen cooperation between research institutions and between universities and industry, to expand the quality and quantity of researchers, and to encourage research activities in line with national priorities and fields (water, energy, information and communication, biotechnology, sanitation, environment and other fields). To provide a place to implement these measures in the fields of higher education and scientific research in a comprehensive and

integrated manner, it was planned that six “Technoparks” would be created across the country during the five-year plan period. These would serve as centers of scientific and industrial technology with universities and research centers at their core.

1.2 Project Outline

The overall goal of the Borj Cedria Science and Technology Park Development Plan was to foster science and technology-related human resources, improve R&D capacity, and develop advanced technology industries through industry-government-academia collaboration, by constructing a science and industrial technology cluster in Borj Cedria near Tunis, consisting of higher education, R&D, and industrial park functions, thereby contributing to the strengthening of the country’s industrial competitiveness, promoting employment and economic development.

Under the above Plan, the objective of this project was to provide support for the higher education and R&D functions of the Borj Cedria Science and Technology Park, thereby contributing to human resource development in science and technology for strengthening of the country’s industrial competitiveness.

Loan Approved Amount / Disbursed Amount	8,209 million yen / 4,994 million yen	
Exchange of Notes Date / Loan Agreement Signing Date	June 2005 / June 2005	
Terms and Conditions	Interest Rate	1.5% (0.75% for Scholarship program)
	Repayment Period (Grace Period	25 years (40 years for Scholarship program) 7 years (10 years for Scholarship program))
	Conditions for Procurement	General untied
Borrower / Executing Agency(ies)	The Government of the Republic of Tunisia / Ministry of Higher Education and Scientific Research (MESRS[1])	
Project Completion	March 2020	
Target Area	Borj Cedria near Tunis	
Main Contractor(s) (Over 1 billion yen)	None	

[1] MESRS: Ministère de l’Enseignement Supérieur et de la Recherche Scientifique.

Main Consultant(s) (Over 100 million yen)	None
Related Studies (Feasibility Studies, etc.)	The Special Assistance for Project Formation (SAPROF) for Borj Cedria Science and Technology Park (2004)
Related Projects	[Technical Cooperation] • The Project on the Management of Technopark in Borj Cedria (2006-2009) [Science and Technology Research Partnership for Sustainable Development (SATREPS)] • Valorization of Bio-resources in Semi-Arid and Arid Land for Regional Development (2010-2015) • The Project for Valorization of Bioresources in Semi and Arid Land Based on Scientific Evidence for Creation of New Industry (2016-2021)

2. Outline of the Evaluation Study

2.1 External Evaluator

Keishi Miyazaki, OPMAC Corporation

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: October 2023 – January 2025

Duration of the Field Study: February 25 – March 14, 2024, May 26 – May 30, 2024

3. Results of the Evaluation (Overall Rating: A[2])

3.1 Relevance/Coherence (Rating: ④[3])

3.1.1. Relevance (Rating: ③)

3.1.1.1 Consistency with the Development Plan of Tunisia

The key items and priorities in the *Tenth Five-Year Plan (2002-2006)* at the time of the appraisal, and details of the planned "Technopark," a scientific and industrial technology cluster with universities and research institutions at its core, are described in "1.1 Background." In addition, Tunisia's medium-term human resources development policy, the Strategy for *Higher Education, Science and Technological Research 2010*, called for an increase in the number of science degree holders, the promotion of entrepreneurship development, a concentration of education and research in priority fields in line with national development

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[3] ④: Very High, ③: High, ②: Moderately Low, ①: Low

strategies and industry needs, and the promotion of industry-academia collaboration with a view to securing and creating employment, in line with the Five-Year Plan.

The National Development Plan 2023-2025 at the time of the ex-post evaluation was based on Tunisia's 17 vision concept, *"Note d'Orientation Tunisie 2035" (Vision 2035)*. The vision concept is structured around six axes, with the core concepts of private-sector-led economic growth and job creation, the development of high value-added sectors, the strengthening of human capital and the promotion of a vibrant civil society. Of these, "Axis 2: Knowledge-based economy for innovation and creativity" includes the strengthening of skills, R&D, digital transition and the promotion of innovation. In addition, the objectives of *the Strategic Plan for the Reform of Higher Education and Scientific Research 2015-2025* include: (i) increasing employment opportunities for students by improving the quality of university education; (ii) identifying education and other priority fields that meet the needs of society; (iii) strengthening the partnership between the socio-economic community and universities by strengthening the role of Technoparks (incubators, technology transfer organizations, etc.) and interface mechanisms; (iv) creating added value and increasing productivity by promoting joint projects between research organizations and companies, and the involvement of companies in R&D activities; and (v) promoting the creation of spin-off companies and innovative companies through the utilization and practical application of research outputs, etc.

3.1.1.2 Consistency with the Development Needs of Tunisia

At the time of the appraisal, strengthening the competitiveness and diversification of industry through R&D was an urgent policy issue in Tunisia. The country's unemployment rate was high, at approximately 14% (2003), and securing employment for young people aged 25 or younger, who accounted for about half of the unemployed, was also a particularly important issue. The number of students in higher education in the country was increasing, and the total number of students was expected to reach approximately 490,000 in 2011, making it necessary to increase the number of courses and facilities at educational institutions. In terms of the employment of graduates, it was noted that there was a mismatch between the expertise of new graduates and the requirements of the labour market, which made it difficult for graduates to find employment.

At the time of the ex-post evaluation, Tunisia, whose main industry was tourism, and which was highly dependent on processing trade with Europe, had been hit hard by the COVD-19 pandemic and was still in the process of economic recovery. Tunisia's unemployment rate averaged 15.4% in 2022 and 15.9% in 2023. In particular, the unemployment rate for higher education graduates has remained high, with an average of 23.4% in 2022 and 23.7% in 2023. The project established three higher education institutions and four research centers in the Borj Cedria Technopark, which are developing and implementing education and training programs

that meet market needs in collaboration with companies, while also expanding joint research with, and services for, companies. However, Tunisia's innovation capacity from 2011 to 2023 had its highest ranking at 59th position in the Global Innovation Index (GII)[4] in 2012, and since then it has remained between 66th and 79th positions. There is a continuing need to improve Tunisia's innovation capacity in order to strengthen its industrial competitiveness.

3.1.1.3 Appropriateness of the Project Plan and Approach

Although some changes were made to the project scope, the overall concept and content of the project remained unchanged. Learning from lessons from past projects in the field of education and R&D[5], the project implemented: (i) the provision of intangible support through JICA related projects such as the technical cooperation project "Project on the Management of the Technopark in Borj Cedria," other types of technical assistance, and the dispatch of senior volunteers (environmental education, applied chemistry, architecture, and Japanese language) in addition to the scholarship program in Japan, (ii) support for the procurement of equipment for research through the dispatch of procurement experts (technical assistance), and (iii) an examination of the possibility of strengthening financial resources through the commercial utilization of research outputs and industry-government collaboration in research, and with a proposal for the establishment of a platform for industry-academia collaboration by the consulting services of the project. According to the MESRS, the series of support measures implemented by JICA were highly evaluated for their significant contribution to strengthening the organizational capacity of the Technopark researchers and staff, mainly in the areas of research project management, technology monitoring, strategy and marketing. Meanwhile, during the project implementation period, the JICA Tunisia Office and the relevant department at JICA Headquarters conducted regular monitoring (quarterly/monthly), attended the quarterly project monitoring committee meetings, accompanied the project team on site visits, and coordinated with related JICA projects. According to MESRS, the JICA Tunisia Office was very cooperative and flexible, and their project management capabilities and continuous support were recognized as being important for the successful implementation of this project.

[4] The Global Innovation Index (GII), published by the World Intellectual Property Organization (WIPO), analyzes, assesses and ranks the innovation capacity of 132 countries and territories (economies) worldwide, comprising a total of seven sub-indices (Institutions, Human Capital and research, Infrastructure, Market sophistication, Business sophistication, Knowledge and technology outputs and Creative outputs).

[5] At the time of the appraisal, lessons learned from past projects in the field of education and R&D were that (i) it is important to provide not only tangible support but also capacity building and intellectual support, (ii) when procuring equipment, it is necessary to use consultants and to respond flexibly to the needs of end users while paying attention to avoiding obsolescence, and (iii) there is the need to secure sufficient budgets for the operation and maintenance of facilities and equipment, and to make self-help efforts through joint research with the private sector as necessary.

3.1.2 Coherence (Rating: ④)

3.1.2.1 Consistency with Japan's ODA Policy

At the time of the appraisal, *Japan's Country Assistance Program for the Republic of Tunisia (formulated in 2002)* identified three priority areas: (i) support for upgrading industry, (ii) support for water resources development and management, and (iii) support for environmental initiatives. The project aimed to develop science and engineering personnel through collaboration between industry, government and academia, improve R&D capacity and foster advanced technology industries, particularly in the fields of biotechnology, water resources and the environment, and renewable energy. This was consistent with the three priority areas mentioned above. In addition, in *the Operation Policy for Overseas Economic Cooperation (2005-2007)*, the priority areas were "infrastructure development for sustainable growth," "support for global issues" and "support for human resources development," and for Tunisia, "economic and social infrastructure development," "human resources development" and "addressing environmental conservation." The project is consistent with all of the above priority areas.

3.1.2.2 Internal Coherence

At the time of the appraisal, it was envisaged that there would be collaboration with JICA technical cooperation[6]. This included: (i) training in Japan for researchers from the National Institute for Research in Science and Technology (INRST), who conduct research in the three fields of biotechnology, water resources and the environment, and renewable energy; (ii) the dispatch of experts (Japanese researchers) in the above three fields; (iii) the dispatch of experts in utilization and commercialization (support for the establishment and operation of Technology Licensing Offices (TLOs) and the development of systems for managing intellectual property rights, which is a prerequisite for this), and (iv) training in Japan related to the operation of Technoparks. The above collaboration was implemented mostly as planned.

In addition, the technical cooperation project, the "Project on the Management of the Technopark in Borj Cedria" (2006-2009) was implemented. Training on the management of intellectual property rights and R&D projects in collaboration with industry carried out in the project has led to an increase in the number of patents and projects in collaboration with industry in the project's target research centers. This was due to the synergistic effects of the improvement of the R&D environment through the development of facilities and equipment and the training of human resources through the scholarship program. Moreover, the

[6] At the time this project was planned in 2005, the former Japan Bank for International Cooperation (JBIC) was the executing agency for Japanese ODA loans, while the former Japan International Cooperation Agency (JICA) was the executing agency for grant aid and technical cooperation. Subsequently, in 2008, the overseas economic cooperation departments of the former JBIC and the former JICA were integrated to form the current JICA.

"Valorization of Bio-resources in Semi-Arid and Arid Land for Regional Development" (2010-2015) and the "Project for Valorization of Bioresources in Semi- and Arid Land Based on Scientific Evidence for the Creation of New Industry" (2016-2021) were implemented under the scheme of the Science and Technology Research Partnership for Sustainable Development (SATREPS). The R&D capabilities of the Biotechnology Research Center (CBBC[7]), one of the research centers targeted by this project was improved through the implementation of these SATREPS projects. As a result of these SATREPS projects, two domestic and four overseas patent applications have been filed, more than 200 original research papers have been published, and 20 industry-academia joint research projects have been conducted. Furthermore, a new food ingredient called "HIF1STEM" has been developed that activates stem cells using an extract from the leaves of a North African variety of olive, which was discovered during the research process of SATREPS. This was commercialized by a private company that participated in SATREPS. In this way, these SATREPS projects have led to tangible social implementation.

3.1.2.3 External Coherence

In 2004, Tsukuba University established the Tsukuba University Center for North African Studies (now the Tsukuba University Tunis Office[8]) in Tunis, and as it had already established a base for academic exchange in Tunisia, it was assumed at the time of the appraisal that there would be collaboration with Japanese universities, including Tsukuba University. In fact, Japanese universities, with Tsukuba University at the center, collaborated with JICA (at the time, the former Japan Bank for International Cooperation) from the project formulation stage to the implementation stage. Specifically, Tsukuba University played a leading role in the scholarship program in Japan, providing support for the matching of Tunisian students with Japanese universities, and accepting Tunisian students in Japan. The University of Tsukuba was also the team leader in the Project on the Management of the Technopark in Borj Cedria (2006-2009), which was implemented in parallel with this project. Furthermore, two SATREPS projects were carried out as joint research projects between Japanese universities, mainly the University of Tsukuba, and the Tunisian Government and universities, including CBBC. Through the implementation of SATREPS, not only did the R&D capacities of the research centers covered by the project improve, but also links were established with universities in Japan, Tunisia and Morocco, contributing to the promotion of an international research network. The implementation of the SATREPS and the promotion of international

[7] CBBC: Centre de Biotechnologie de Borj Cédria.

[8] The Tunis Office of Tsukuba University was established in 2014 by merging Tsukuba University's Alliance for Research on the Mediterranean and North Africa (ARENA) and Tsukuba University's Tunis Office for Overseas University Collaboration (Bureau de Universite de Tsukuba a Tunis pour les Universites Japonaises: BUTUJ).

research networks in the Maghreb region were more collaborative than initially envisaged. Compared to the five other donor-supported Technoparks (Sousse, Sfax, Sidi Thabet, Bizerte and Monasti), the Borj Cedria Technopark is also the most complete in terms of the number of educational and research facilities, and the diversity of specializations. The experience of the Borj Cedria Technopark in industry-government-academia collaboration and Technopark management has been transferred and utilized in other Technoparks in the country. In addition, the experience of the Borj Cedria Technopark has been used as a reference not only in Tunisia, but also in Algeria and Mauritania for the development of technoparks[9]. However, there was no coordination or collaboration with other donors directly related to this project.

This project was consistent with the development plan and development needs of Tunisia at the time of the appraisal and at the time of the ex-post evaluation. Consistency with Japan's ODA policy was also confirmed. Collaboration with other JICA projects and with Tsukuba University showed more synergies than initially envisaged.

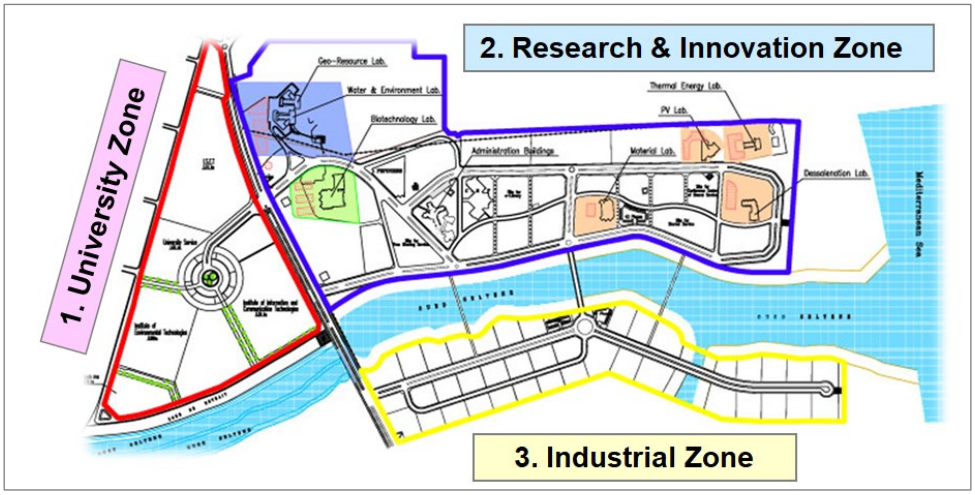
Therefore, the relevance and coherence of the project are very high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The overall project involved the establishment of a science and industrial technology cluster (Technopark), with a total area of approximately 91 ha, in the area of Borj Cedria, in the suburbs of Tunis. The Technopark consisted of three zones: the "University Zone (higher education function)," the "Research and Innovation Zone (R&D function)," and the "Industrial Zone (industrial park function)". This project provided support for the higher education function and R&D function. For details, please refer to the "Comparison of the Original and Actual Scope of the Project" at the end of this document.

[9] As the MESRS in Tunisia and the Ministry of Higher Education and Scientific Research in Mauritania had been in contact with each other for some time, a delegation from Mauritania visited Tunisia to make a call at the Borj Cedria Technopark and learn about the technopark's strategy, and are considering a plan to construct a technopark in Mauritania based on the example of the Borj Cedria Technopark. In March 2024, the director of the Tunisian MESRS visited Mauritania and gave a presentation on the technopark. In Algeria, the Tunisian MESRS presented the Borj Cedria Technopark at a symposium held in Germany, and the Algerian delegation expressed their interest in the project, indicating that they would like to use the public-private partnership model of the Technopark as a reference for the development of their own Technopark.



Source: Management Company of the Technopole de Borj Cedria

Figure 1 Overall View of Borj Cedria Technopark

Specifically, the project was made up of the following components.

(1) University Zone: Construction of three higher education institutions[10] (the Higher Institute of Environmental Science and Technology (ISSTE[11]), the Higher Institute of Information and Communication Technology (ISTIC[12]), and the Higher Institute of Technology (ISET[13])), a university restaurant shared by all three schools, and a sports center. Also, the procurement of equipment for all components:

(2) Research and Innovation Zone: Procurement of research equipment for the existing National Institute for Scientific and Technological Research (INRST[14]), the construction and procurement of shared service facilities (conference halls, meeting rooms, canteens, spaces for banks and shops, etc.) and attached facilities (business support service centers) in the Technopark, and the construction and procurement of the central library;

(3) Scholarship program: Support for obtaining a doctorate at Japanese universities (training and capacity building for personnel engaged in research in the fields of biotechnology, water resources and the environment, and renewable energy); and

(4) Consulting service.

Regarding (1), ISSTE and ISTIC were implemented mostly as planned. However, the fire

[10] Higher education in Tunisia is provided by three types of institution: (i) Universities, which are comprehensive educational institutions; (ii) Higher Institute of Technological Studies, which train mid-level engineers; and (iii) Higher Institute for Teacher Training, which train teachers. The higher education institutions covered by this project are (ii) Higher Institute of Technological Studies.

[11] ISSTE: Institut Supérieur des Sciences et Technologies de l'Environnement.

[12] ISTIC: Institut Supérieur des Technologies de l'Information et de la Communication.

[13] ISET: Institut Supérieur des Etudes Technologiques.

[14] INRST: Institut National de Recherche Scientifique et Technologique.

detection system facility work at ISTIC had not been completed (it was scheduled for completion in June 2024). Among the target schools, ISET was changed to the National School of Advanced Science and Technology (ENSTAb[15]). The reason for this is that, although the original plan was to establish ISET, a school for training mid-level engineers (technicians) with a three-year engineering course, there was a high demand from the companies located in the Technopark for the training of highly specialized engineers. The decision was therefore made to establish ENSTAb, a five-year engineering school. Although the facilities and equipment for ENSTAb have been constructed and procured, some of the piping work was still incomplete (scheduled for completion in March 2025). The university restaurant and sports center shared by the three schools were implemented as planned. However, during the period of school closure from 2020 to 2021 due to the spread of COVID-19, the sports center was badly damaged, with theft and vandalism of equipment and facilities (sports equipment, electrical cables, doors, window frames, fixtures, etc.), and it has been unusable since then. The MESRS, with the support of the World Bank, is rehabilitating the sports center and university restaurant in 2024. In addition, the unused balance of the project cost was used to construct an university residence for female students (600 beds) and to procure equipment as an additional scope.

Regarding (2), the existing INRST was reorganized into three research centers: the Energy Research and Technology Center (CRTEn[16]), the Water Resources Research and Technology Center (CERTE[17]) and CBBC, and the construction and expansion of the facilities of each research center was carried out using the Tunisian government's own funds. In this project, the procurement of research equipment for these three research centers was carried out largely as planned. In addition, the shared service facilities at the Technopark were integrated with the attached facilities, and the scale was greatly reduced, with the design changed to a facility with multi-purpose space functions. At the time of the post-evaluation, approximately 90% of the work had been completed. Due to financial difficulties of the contractor, the contract was cancelled and a new tender was held for the remaining work. However, this has twice been unsuccessful. The remaining work is currently being carried out under a negotiated contract with a different contractor (scheduled for completion in the first half of 2025). As a result of this, the construction of the incomplete parts of the shared facilities is being carried out with the Tunisian government's own funds. Furthermore, the expansion of the National Center for Material Science Research (CNRSM[18]) (construction of a new administration building and research building) and the procurement of research equipment were carried out as additional scopes using the remaining unused project funds.

[15] ENSTAB: Ecole Nationale des Sciences et Technologies Avancées à Borj Cédria.
[16] CERTEn: Centre de Recherches et des Technologies de l'Energie.
[17] CERTE: Centre de Recherches et des Technologies des Eaux.
[18] CNRSM: Centre National de Recherches en Sciences des Matériaux.

Regarding (3), the scholarship program at Japanese universities was completed as planned, and 8 of the 29 Tunisian students[19] (who had obtained PhDs) were employed at research centers in the Technopark.

Regarding (4), a firm and a consortium of consultants were contracted for this project, and consulting services were implemented mostly as planned.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was 8,207 million yen (of which Japanese ODA loan was 4,994 million yen), compared to the planned project cost of 10,946 million yen (of which Japanese ODA loan was 8,209 million yen), so it was within the plan (75% of the planned cost). Due to the impact of exchange rate fluctuations (strong yen/weak Tunisian dinar), there was an unused balance of project expenses, so the expansion of the CNRSM, the procurement of equipment, and the construction of university residence and procurement of equipment were added to the scope of work in 2013. As mentioned above, the unfinished part of the shared service facilities in the Technopark will be funded by the Tunisian government. The comparison between the planned and actual project costs is shown in Table 1.

For reference, if the project costs are compared in Tunisian dinars, the actual project cost was 145 million Tunisian dinars, which slightly exceeded the planned cost of 127 million Tunisian dinars (114% of the planned cost).

Table 1 Comparison of Planned and Actula Project Cost

Unit: Million yen

Item	Plan			Actual
	Foreign Currency	Local Currency	Total	Total
Construction work	0	4,530	4,530	3,311
Procurement of equipment	3,228	918	4,146	4,193
Scholarship program	387	0	387	258
Consulting service	310	161	471	247
Contingency	200	194	394	-
Administration cost	115	122	237	199
Tax and duties	31	750	781	-
Total	4,271	6,675	10,946	8,207

Source: Documents provided by JICA, response to questionnaire by MESRS
Note: (Plan) Exchange rate: 1 Tunisia dinar=86.2 yen (As of November 2004)
(Actual) Exchange rate: 1 Tunisia dinar=56.45 yen (Average of 2005-2020)

3.2.2.2 Project Period

The actual project period was 178 months (June 2005 to March 2020), which significantly

[19] The 29 Tunisia students included 15 from Tsukuba University, 3 from Tokyo University of Agriculture and Technology, 2 from Tokyo University, 2 from Hokkaido University, 1 from Seikei University, 1 from Tokyo University of Agriculture, 1 from Tohoku University, 1 from Toyota Technological Institute, 1 from Kyoto University, 1 from Kyushu University and 1 from Ryukyus University.

exceeded the planned project period of 76 months (June 2005 to September 2011) (234% of the planned period). As a result, the expiry date of the loan agreement was extended twice, from the original December 2012, finally to December 2018. In this ex-post evaluation, the definition of project completion was set as the end of the one-year warranty period for procured equipment[20]. The comparison between the planned and actual project periods is shown in Table 2.

Table 2 Comparison of Planned and Actual Project Period

Item	Plan	Actual
Signing of Loan Agreement	June 2005	June 2005
From Selection of consultants to Tender	June 2005 – August 2006	June 2006 – June 2007 June 2013 – April 2018
Consulting service	August 2006 – December 2010	June 2007 – October 2011 April 2018 – March 2019
From tender for construction woks to signing of contract	September 2005 – October 2007	March 2010 – March 2017
Construction work	July 2006 – May 2009	December 2010 – December 2024
From tender for procurement of equipment to signing of contract	November 2006 – February 2007 January 2008 – July 2008	August 2008 – March 2018
Installation of equipment	June 2006 – September 2010	March 2010 – March 2019
Scholarship program	August 2006 – March 2010	June 2017 – October 2011
Project completion	September 2011	March 2020

Source: Documents provided by JICA, response to questionnaire for MESRS
Note 1: Definition of project completion: the end of the one-year warranty period for procured equipment (one year after the installation of the last equipment in March 2019).
Note 2: The above table excludes the actual project period relating to the unfinished tender and works for the fire detection system facility at ISTIC, the piping facility at ENSTAb, and the shared service facility in the research and innovation zone.

The reason for the delay was that the implementing agency changed from the original two-ministry system of the Ministry of Scientific Research, Technology and Skills Development and the Ministry of Higher Education to the Ministry of Higher Education and Scientific Research (MESRS) as a result of the merger of the two ministries. With this change, the responsibility for coordination work was transferred from the Borj Cedria Technopark Special

[20] The Project Memorandum for this project (dated December 2005) states that the completion of the project was defined as the time when the following four conditions were met: (i) completion of construction work and equipment installation, (ii) completion of the scholarship program, (iii) completion of the one-year warranty period, and (iv) completion of consulting services. The construction work that was incomplete at the time of the ex-post evaluation was: a) the piping work at ENSTAb (scheduled for completion in March 2025), b) fire detection system facility work at ISTIC (scheduled for completion in June 2024), and c) shared service facilities in the Research and Innovation Zone (scheduled for completion in the first half of 2025). As the expiry date of the loan agreement for this project ended in December 2018, the construction of the above-mentioned incomplete works is scheduled to be carried out using the Tunisian government's own funds. On the other hand, although the project cost for the construction of the shared service facilities was disbursed and construction began as a part of the Japanese ODA loan, construction was later suspended due to the bankruptcy of the contractor. The incomplete works of the project were therefore carried out by another contractor. For this reason, the JICA Tunisia Office considers the project to be officially complete when all construction works on the shared service facilities, including the unfinished parts, have been completed, including the part that funded by the Japanese ODA loan. Meanwhile, the expiry date of loan agreement for this project was December 2018, with the unfinished construction works to be carried out using the Tunisian government's own funds. Even if the facilities mentioned in a), b), and c) above are not completed, this will not significantly hinder the manifestation of the project's effects and impacts. Therefore, in this ex-post evaluation, "the end of the one-year warranty period for the procured equipment" is considered to be the completion of the project.

Purpose Unit[21] to the Directorate General for Promotion of Research, MESRS, and so on. As a result, there was a delay of around two years in the start of the preparation of the basic specifications for the construction of the various facilities to be built by the Ministry of Equipment and Housing[22] to which authority was transferred. In addition, initially, in accordance with the procurement policy of the Ministry of Higher Education (at the time), equipment procurement was not divided into lots, and a one-item-per-lot system was adopted. Due to problems with the procurement system, such as the low accuracy of technical specifications and a shortage of staff in the procurement department of the Ministry of Higher Education, this led to delays and prolonged procedures for equipment procurement[23]. In addition, construction work was also delayed significantly due to factors such as prolonged tendering procedures, a change in procurement methods from international competitive bidding (ICB) to local competitive bidding (LCB), and delays in construction work due to problems with contractors' implementation and financial capabilities. Furthermore, the Jasmine Revolution in Tunisia (2010-2011), which was the starting point of the Arab Spring, and the resulting domestic turmoil that continued for several years, also affected the project schedule. Although construction work continued during the revolution, the poor state of the domestic economy led to many contractors falling into financial crisis or bankruptcy, which in turn led to delays and interruptions in construction work.

In this project, some of the scope was revised and additional outputs were added, the outputs were mostly implemented as planned, and the project costs were within the plan, although the project period significantly exceeded the plan. Therefore, the efficiency of the project is moderately low.

[21] Established in October 2002 by government ordinance as an organization with the authority to carry out various surveys, supervise development work, coordinate between components, and screen companies planning to move in, etc., during the development stage of the Borj Cedria Technopark.

[22] For construction work ordered by the central government agencies in Tunisia, the Ministry of Equipment and Housing is responsible for administrating the entire process from procurement to construction supervision, having been delegated authority by the agencies.

[23] In response to this, in 2016 JICA dispatched experts to provide support for the procurement of research equipment (technical cooperation), and support to MESRS in relation to technical specifications, tender documents and tender evaluation.

Facilities and Research Equipment of the Project

Picture 1 ISSTE

Picture 2 ISTIC

Picture 3 ENSTAb

Picture 4 Common Facilities (University Residence for Students, University Restaurant)

Picture 5 CBBC

Picture 6 CERTE

Picture 7 CRTEn

Picture 8 CNRSM

(Source: Evaluator)

3.3 Effectiveness and Impacts[24] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The operation and effect indicators set at the time of appraisal were as follows: for higher education institutions, the number of students, the number of students who obtained degrees, the number of teachers, the higher education enrolment rate; for research centers, the number of research laboratories, the number of researchers, the number of peer-reviewed scientific publications, the number of doctoral degree holders from the scholarship program. For the additional scope of ENSTAb and CNRSM, there were no set baseline or target values, so they are listed here as reference information.

[24] When providing the sub-rating, Effectiveness and Impacts are to be considered together.

(1) Higher Institute of Science and Technology (ISSTE)

	Baseline	Target Value	Actual Value								
	2004	2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
		2 Years After Completion						Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
1. No. of students											
a) License/diploma course (3 years)	160	1,000	1,366	1,103	869	603	469	412	436	542	610
b) Master course (2 years)	0	-	112	109	120	147	133	123	128	123	137
2. No. of students who obtained the degrees											
a) License/diploma course	0	360	383	280	244	225	154	102	124	89	88
b) Master course	0	-	60	35	29	55	48	45	58	44	48
3. No. of teachers	7	129	N.A.	105	105	108	108	101	101	94	94

Source: Documents provided by JICA, and documents provided by ISSTE

The number of students in the license/diploma course at ISSTE was 542 in 2022, which was below the target of 1,000 two years after project completion (achievement rate of 54%). The number of students exceeded 1,000 until 2016, but has decreased since 2017, and by 2020 it had fallen to around 40% of the number of students in 2016. According to ISSTE, the reasons for this are thought to be: (i) the number of people holding the baccalaureate (a national qualification that serves as both a qualification for completing secondary education and for entering higher education) has been decreasing in recent years[25]; (ii) many students have come to aspire to enter higher education institutions with faculties in the field of information and communications; and (iii) the number of private universities teaching in the environmental field has increased, and this has led to a widening of educational options, with some students choosing to attend private universities[26]. On the other hand, the number of students enrolled in the master's course has remained stable, with more than 120 students enrolled every year since 2017. The number of students who have obtained a degree in the license/diploma course has not reached the target of 360, with the actual number being 89 (achievement rate of 25%). The number of teachers has not reached the target of 129, with the actual number being 94 (achievement rate of 73%).

[25] The background to this may be the recent decline in the birth rate and an increase in the number of emigrants from Tunisia.

[26] The proportion of students at private schools in all higher education institutions in Tunisia increased from 6.5% in the 2012/13 academic year to 14.7% in the 2022/23 academic year.

(2) Higher Institute of Information and Communication Technology (ISTIC)

	Baseline	Target Value	Actual Value								
	2004	2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
		2 Years After Completion						Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
1. No. of students											
a) License/diploma course (3 years)	0	1,180	413	794	911	1,055	1,254	1,242	1,424	1,527	1,426
b) Master course (2 years)	0	-	0	0	0	137	234	252	214	140	154
2. No. of students who obtained degrees											
a) License/diploma course	0	304	0	94	159	232	202	234	310	322	N.A.
b) Master course	0	-	0	0	0	0	52	53	58	34	N.A.
3. No. of teachers	0	100	50	103	108	139	156	160	168	164	N.A.

Source: Documents provided by JICA, and documents provided by ISTIC

The number of students enrolled in the license/diploma course at ISTIC was 1,527 in 2022, which was well above the target value of 1,180 for two years after project completion (achievement rate of 129%). The number of people who have obtained a degree in the license/diploma course has also been achieved, with the actual number being 322, compared to the target value of 304 (achievement rate of 106%). The number of teachers has also been achieved, with the actual number being 164 compared to the target value of 100 (achievement rate of 168%).

(3) National School of Advanced Science and Technology (ENSTAb) (Additional Scope)

	Baseline	Target Value	Actual Value								
	2004	2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
		2 Years After Completion						Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
1. No. of students											
a) License/diploma course of national engineering (5 years)	0	-	138	188	157	169	161	158	187	217	231
b) Master course (2 years)	0	-	0	0	0	0	0	0	22	42	87
2. No. of students who obtained degrees											
a) License/diploma course of national engineering	0	-	0	0	0	55	57	37	44	52	N.A.
b) Master course	0	-	0	0	0	0	0	0	0	14	30
3. No. of teachers	0	-	8	14	16	31	31	32	31	36	36

Source: Documents provided by JICA, and documents provided by ENSTAb

For ENSTAb, no baseline or target values were set. In 2022, the number of students in the license/diploma course of national engineering was 217, the number of degree holders in the license/diploma course of national engineering was 52 and the number of instructors was 36. ENSTAb opened a new master's course in 2022.

(4) Higher Education Enrolment Rate

	Baseline	Target Value	Actual Value								
	2004	2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
		2 Years After Completion						Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
1. Overall Tunisia (%)	33	50	36.09	44.88	41.89	41.72	45.62	42.11	57.52	53.27	50.91
2. Percentage of Females (%)	38	60	63.17	63.73	64.53	65.43	65.95	66.01	65.48	65.90	66.08

Source: Documents provided by JICA, and the National Institute of Statistics, Tunisia
Note: The data for the actual value is taken from existing government statistics and shows the rate of university entrance (= rate of baccalaureate acquisition).

The higher education enrolment rate in Tunisia was 53.27% in 2022, compared to the target value of 50% in the years after project completion, so the target was achieved (achievement rate of 107%). The percentage of female students in higher education was also 65.90%, compared to the target value of 60%, so this target was also achieved (110%).

(5) Biotechnology Research Center (CBBC) (Biotechnology Sector)

	Baseline	Target Value	Actual Value								
	2004	2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
		2 Years After Completion						Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
1. No. of research laboratories	5	9	6	6	6	6	6	6	6	6	6
2. No. of researchers	37	92	86	86	85	86	85	83	82	86	86
3. No. of peer-reviewed scientific publications	36	100	89	133	153	108	115	125	149	185	165

Source: Documents provided by JICA, and documents provided by CBBC

The number of research laboratories at CBBC was six in 2022, compared to the target value of nine two years after project completion, so the target has not been achieved (achievement rate of 75%). The number of researchers was 86, which was a general achievement of the target value of 92 (achievement rate of 93%). The number of peer-reviewed scientific publications was 185, which fully achieved the target value of 100 (achievement rate of 185%).

(6) Water Resources Research and Technology Center (CERTE) (Water Resource and Environment Sector)

	Baseline	Target Value	Actual Value								
	2004	2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
		2 Years After Completion						Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
1. No. of research laboratories	4	8	3	5	5	5	5	5	5	5	5
2. No. of researchers	39	95	87	86	86	86	85	85	89	88	88
3. No. of peer-reviewed scientific publications	16	48	66	91	72	112	121	96	121	117	114

Source: Documents provided by JICA, and documents provided by CERTE

The number of research laboratories at CERTE was five in 2022, which was less than the

target value of eight, two years after project completion (achievement rate of 62%). The number of researchers was 88, which mostly achieved the target value of 95 (achievement rate of 93%). The number of peer-reviewed scientific publications was 117, which was well above the target value of 48 (achievement rate of 243%).

(7) Energy Research and Technology Center (CRTEn) (Renewable Energy Sector)

	Baseline	Target Value	Actual Value								
	2004	2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
		2 Years After Completion						Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
1. No. of research laboratories	3	8	5	5	5	5	4	4	4	4	4
2. No. of researchers	28	84	63	65	69	69	66	69	70	73	79
3. No. of peer-reviewed scientific publications	34	106	-	-	-	114	85	114	113	127	137

Source: Documents provided by JICA, and documents provided by CRTEn

The number of research laboratories at CRTEn was four in 2022, which was less than the target value of eight, two years after project completion (achievement rate of 50%). The number of researchers was 73, which mostly achieved the target value of 84 (achievement rate of 87%). The number of peer-reviewed scientific publications was 127, which was a full achievement of the target value of 106 (achievement rate of 120%).

(8) National Center for Material Science Research (CNRSM) (Additional Scope)

	Baseline	Target Value	Actual Value								
	2004	2013	2015	2016	2017	2018	2019	2020	2021	2022	2023
		2 Years After Completion						Completion Year	1 Year After Completion	2 Years After Completion	3 Years After Completion
1. No. of research laboratories	-	-	2	2	3	3	3	3	3	3	3
2. No. of researchers	-	-	38	41	42	41	40	45	43	43	45
3. No. of peer-reviewed scientific publications	-	-	66	75	71	54	50	43	50	58	70

Source: Documents provided by JICA, and documents provided by CNRSM

There are no baseline and target values for CNRSM. At the time of the ex-post evaluation in 2023, there were three research laboratories, 45 researchers, and 70 peer-reviewed scientific publications.

(9) Scholarship Program

	Baseline	Target Value	Actual Value
	2004	2010	2011
No. of doctoral degree holders from scholarship program	-	30	29

Source: Documents provided by JICA, and documents provided by MESRS

The number of doctoral degree holders from the scholarship program was 29 in 2011, compared to the target value of 30 in 2010, so the target was mostly achieved (achievement rate of 97%).

The reason why the target numbers of research laboratories for CBBC, CERTE and CRTEn were not achieved is related to the introduction of the cluster management concept into the management of the research institutions run by MESR. When the target number of research laboratories for research centers was set during the appraisal of this project, it was assumed that there would be a laboratory for each research field/area, and that each laboratory would have around 10 researchers. Subsequently, with the introduction of cluster management, a new research management system was introduced, where instead of setting up laboratories for each individual research field/area, several related research fields/areas are held in one laboratory, with about 20 researchers per laboratory, and emphasis is placed on related research themes and collaboration among researchers[27]. According to CBBC, CERTE and CRTEn, the research activities in the research fields/areas envisaged at the time of the appraisal were adequately covered by the new laboratory management system. Thus, it was not necessarily appropriate to simply compare target and actual values at the time of the appraisal and at the time of the ex-post evaluation, as the preconditions, such as the functions and management system of the laboratories of the target research centers, were different. For this reason, the degree of achievement of the operation and effect indicator "number of research laboratories" was not included in the evaluation judgement in this ex-post evaluation.

3.3.1.2 Qualitative Effects (Other Effects)

(1) Human Resources Development in Science and Technology

The target three higher education institutions of the project are specialized technical schools that aim to train competent middle managers and mid-level engineers who meet the needs of industry. In the three target schools, the construction of school buildings and the provision of laboratories and technical equipment under the project have improved the learning environment and enabled the implementation of more advanced educational programs tailored to employment aptitude, which has proven to be effective in developing human resources in science and technology.

ISSTE has established training courses in collaboration with industry, developed and implemented training programs focusing on skills that meet market needs and participated in international research projects. In addition, seminars, conferences and open days are organized

[27] Several sub-groups are set up within one laboratory. Narrowing down the number of laboratories has the advantage that many types of research equipment can be concentrated in one laboratory, making it easier for researchers to access research equipment.

on a regular basis, providing active opportunities for interaction and information exchange between schools, students and industry. ISTIC's facilities and equipment are also available for use by external parties, and for example, the military academy conducts training every year using the radar system introduced in this project. In addition, a master's degree program has been established in collaboration with private companies (a cluster group of 50 companies), and there have been cases where students who have completed the program have gone on to work for companies participating in the program after graduation. ENSTAb has a startup support unit in collaboration with the University of Carthage, and it also carries out activities to support student startups. Tunisia's information and communications technology (ICT) education is ranked 5th in international rankings, and because of the high demand for ICT engineers from companies around the world, many graduates of ISTIC and ENSTAb in particular have the opportunity to find employment at ICT-related companies overseas.

Meanwhile, the four target research centers are engaged in educational activities as well as research activities, and in collaboration with higher education institutions inside and outside the Technopark, they accept many master's and doctoral students, and professors at the research centers give lectures at universities and other institutions, while also providing research guidance to students. The target research centers are also contributing to the development of human resources in the fields of science and technology through educational activities.

(2) R&D Capacity Improvement

At the target four research centers, the construction of research facilities and the provision of advanced experimental and research equipment through this project have been recognized as having the effect of expanding and diversifying research fields/areas and scope, advancing research, as well as improving technical capabilities and quality. As shown in "3.3.1.1 Quantitative Effects (Operation and Effect Indicators)," the four research centers publish more than 100 peer-reviewed scientific publications each year. According to a Tunisian professor at the Tsukuba University Tunis Office, which has been working in collaboration with this project, the research capabilities of the four target research centers have improved significantly as a result of the JICA support. This has included human resource development, the construction of research facilities, and the introduction of research equipment. The most notable change has been an increase in researchers' awareness of the importance of patents.

In the scholarship program implemented in this project, the initial plan was that all 29 Tunisian students who had obtained doctorates at Japanese universities would be employed at the research center in the Technopark after returning to Tunisia. In reality, however, the recruitment for the research center was carried out through a competitive examination for all applicants in Tunisia. In addition, the number of researchers to be employed was limited to the

number of vacant posts at each research center at the time, so only eight of the 29 returning students were employed at the research centers in the Technopark[28]. In this sense, the program's effect in terms of raising Tunisia's R&D capabilities by training and improving the skills of researchers in the fields of biotechnology, water resources and the environment, and renewable energy through the scholarship program, and then utilizing these researchers at the research centers in the Technopark, was more limited than initially expected.

However, in an interview survey with six former Tunisian students working at the research center, they recognized that their experience of studying in Japan had made a significant contribution to the improvement of their own capacity as researchers and to their career development. They had been able to conduct research and experiments that would have been impossible in Tunisia, in a state-of-the arts research environment with well-equipped research facilities and equipment and excellent academic advisors at Japanese universities and after returning to their home country, they were able to share their experiences and knowledge gained in Japan with their colleagues at work. In this way, the experiences and knowledge they had gained were shared, and thus there was a transfer of technology. The six people mentioned above still maintain good relationships with their former academic advisors, have since returned to Japan to take up opportunities to conduct research activities, and are working hard to improve their R&D capabilities. In addition, a memorandum of understanding (MOU) on joint research has been signed between CRTEn, where the former scholarship students are working, and the host university, the University of the Ryukyus, and there are cases where this has developed into an international research network. Furthermore, according to MESRS, Tunisian students who have obtained doctorates in Japan are recognized as internationally renowned researchers and have also given lectures at international events. In this sense, the opinion was that the scholarship program had been beneficial for the development of research capabilities and the improvement of the international standing of Tunisia as a whole.

(3) Creation of the Foundation for the Promotion of R&D in Tunisia

Through this project, the construction of facilities (for two schools) and the provision of educational and research equipment (for three schools) were carried out at the three target higher education institutions, and the construction of facilities (for one research center) and the provision of research equipment (for four research centers) were carried out at the four target research centers. The equipment included much expensive and state-of-the-art scientific

[28] As far as confirmed at the time of the ex-post evaluation, in addition to the above eight people, eight people were working at universities in Tunisia (including one person at ENSTAb), three people were working at universities overseas (including one person at Akita University), and five people were working at private companies in Japan and overseas.

equipment that had not previously been available in Tunisia, and this has laid the foundations for international-standard education and research. As mentioned above, the construction of school buildings and the provision of laboratories and technical equipment through this project at the three target schools has improved the learning environment and enabled the implementation of more advanced educational programs tailored to employment aptitude, etc. This has also been effective in fostering science and technology-related human resources. In addition, the four target research centers of this project saw positive effects such as the expansion and diversification of research fields/areas and scope, advancing research, as well as the improvement of technical capabilities and quality, thanks to the construction of research facilities and the provision of advanced experimental and research equipment through the project. Based on the above, it can be said that this project has had a certain effect on the creation of a foundation for the promotion of R&D in Tunisia.

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Efficient R&D through Industry-Government-Academia Collaboration

Since the implementation of this project, research centers have expanded their collaborations with government agencies, industry and international partners, and an environment that promotes innovation has been fostered. Each research center has established a special unit (called a technology valorization and transfer platform) for joint research with industry and the provision of product inspection services and is actively working on industry-academia collaboration and patent acquisition (Table 3). Between 2019 and 2022, CBBC implemented 33 international projects (21 bilateral and 12 multilateral projects) and 19 national projects. Between 2017 and 2023, CERTE signed 70 agreements with socio-economic partners (government agencies, universities, associations, companies, NGOs, etc.) and 30 international projects and 44 domestic projects were underway in 2023. CRTEn has a track record of 22 international projects and 19 domestic projects, has concluded 12 agreements with industry and 25 agreements with academic institutions, and has provided 36 inspection and analysis services to industry. CNRSM has experience of 14 international and domestic projects.

On the other hand, it has not been possible to obtain any specific examples of industry-government-academia collaboration between the tenant companies of the Technopark and higher education institutions and research centers.

Table 3　Number of Domestic Patents obtained by the Target Four Research Centers

	2020	2021	2022	2023
Biotechnology Research Center (CBBC)	0	8	4	3
Water Resources Research and Technology Center (CERTE)	1	5	1	6
Energy Research and Technology Center (CRTEn)	0	2	2	0
National Center for Material Science Research (CNRSM)	1	1	0	4
Total	2	16	7	13

Source: Documents provided by the target four research centers

(2) Strengthening the International Competitiveness of Science, Technology and Industry in the Medium to Long Term

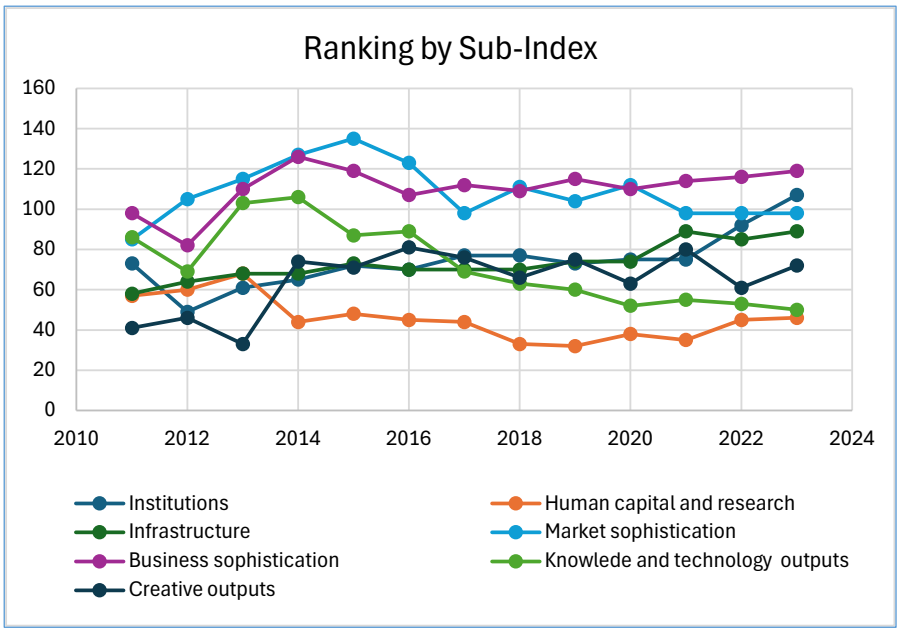
In the Global Innovation Index (GII), Tunisia's innovation capacity from 2011 to 2023 was highest in 2012 at 59th place in the overall GII ranking. After that it remained between 66th and 79th place (Table 4).

Table 4　Changes in Tunisia's Ranking in the Global Innovation Index (GII)

Year	Overall Ranking				Ranking by Sub-Index						
	GII score	GII ranking	Ranking in income group	Ranking in region	Institutions	Human capital & research	Infrastruc -ture	Market sophisti -cations	Business sophisticat -ions	Knowledge & technology outputs	Creative outputs
2011	33.89	66	9	10	73	57	58	85	98	86	41
2012	36.50	59	16	10	49	60	64	105	82	69	46
2013	35.82	70	25	11	61	68	68	115	110	103	33
2014	32.94	78	24	14	65	44	68	127	126	106	74
2015	33.48	76	24	13	72	48	73	135	119	87	71
2016	30.55	77	22	14	70	45	70	123	107	89	81
2017	32.30	74	9	12	77	44	70	98	112	69	76
2018	32.86	66	7	9	77	33	70	111	109	63	66
2019	32.83	70	8	10	73	32	74	104	115	60	75
2020	31.21	65	7	7	75	38	74	112	110	52	63
2021	30.70	71	7	9	75	35	89	98	114	55	80
2022	27.90	73	8	10	92	45	85	98	116	53	61
2023	26.90	79	9	14	107	46	89	98	119	50	72

Source: Global Innovation Index (GII)

Looking at Tunisia's ranking by sub-index, which is the component that determines the overall ranking, "human capital and research" and "knowledge and technology outputs" have had a relative improvement in ranking (Figure 2). For "human capital and research," the composition elements "average total general government expenditure per student, at secondary level" and "share of all tertiary-level graduates in natural sciences, mathematics, statistics, information and technology, manufacturing, engineering and construction as a percentage of all tertiary-level graduates" (indexes) are the factors pushing up the rankings. The score for "knowledge and technology outputs" is high for its composition element "number of articles published in the fields of science and technology" (indicator).



Source: Global Innovation Index (GII)

Figure 2 Changes in Tunisia's Ranking by Sub-Index in the Global Innovation Index (GII)

Although the above shows that the international competitiveness of Tunisia's innovation capacity has not improved noticeably since the implementation of the project, Tunisia still has a comparative advantage internationally in the individual items of "average total general government expenditure per student, at secondary level," "share of all tertiary-level graduates in natural sciences, mathematics, statistics, information and technology, manufacturing, engineering and construction as a percentage of all tertiary-level graduates," and "number of articles published in the fields of science and technology," Since the project also fostered human resources in science and technology in higher education and increased the number of scientific and technological papers as project effects, it is considered that the project has made a certain contribution to strengthening international competitiveness in the above-mentioned individual items.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Environment

At the time of appraisal, the project was classified as Category B, as it was considered to have no significant undesirable effects on the environment in light of the sector, project, and regional characteristics listed in the Japan Bank for International Cooperation's "Guidelines for Confirmation of Environmental and Social Considerations" (April 2002). The Environmental Impact Assessment (EIA) for the construction of the Borj Cedria Technopark was approved by the government in 1998, and no particular negative impact on the natural environment was foreseen, as there are no nature conservation areas or other areas around the project site.

As for hazardous wastewater and waste generated by research activities, ISSTE, in cooperation with the Governorate of Nabeul, properly manages and disposes of wastewater and waste in a dedicated storage facility. ISTIC and ENSTAb are mainly engaged in ICT education and do not discharge hazardous materials that could have a negative impact on the environment. Storage facilities for hazardous waste have been established and managed for each of the four target research centers. Since the Ministry of the Interior is responsible for monitoring hazardous waste, the contents and handling of the storage facilities are regularly checked by the local police. Some of the stored hazardous waste is contracted out to specialized private waste disposal companies authorized by the government for disposal.

CBBC is currently constructing a dedicated waste storage facility on the site, which will be divided into five storage rooms for different types of waste. It was expected that this would be completed by the end of 2024. This waste storage facility is being implemented as the first pilot project in the country supported by MESRS, the Ministry of the Environment, and the Ministry of Industry. If this pilot project is successful, it is envisioned that this model will be disseminated to other research institutions in Tunisia.

(2) Resettlement and Land Acquisition

The land acquisition for the Borj Cedria Technopark had already been completed prior to the implementation of the project, and it was confirmed that the land acquisition had been properly carried out in compliance with Tunisian domestic laws. In addition, as originally planned, no resettlement occurred under the project.

(3) Gender Equality

As shown in Table 5, the percentage of females at the three target higher education institutions and the four research centers is high.

Table 5 Percentage of Females at Target Higher Education Institutions and Research Centers

Organization	Percentage of Females
Higher Institute of Environmental Science and Technology (ISSTE)	80%
Higher Institute of Information and Communication Technology (ISTIC)	52%
National School of Advanced Science and Technology (ENSTAb)	67%
Biotechnology Research Center (CBBC)	More than 50%
Water Resources Research and Technology Center (CERTE)	32%
Energy Research and Technology Center (CRTEn)	35%
National Center for Material Science Research (CNRSM)	50%

Source: Documents provided by the target higher education institutions and research centers

According to the rankings of the United Nations Educational, Scientific and Cultural Organization (UNESCO), Tunisian women are active as scientists in the fields of scientific research and technological innovation, and they are equal to male scientists. In addition, the

project has constructed an university residence for female students as an additional scope, providing a safe and inexpensive living environment for approximately 450 female students from the three target schools. In this way, considerations for female students have been made.

[Results of Qualitative Survey]

In this ex-post evaluation, in order to analyze whether the "prospects for girls' school attendance" benefited all beneficiaries fairly, including those who are likely to be left behind, an interview survey with 32 students (14 males and 18 females) and 18 teachers (8 males and 10 females) from the three target schools was conducted.

In a survey of students, no unequal treatment based on gender or origin (region, ethnicity, etc.) was confirmed in relation to admission or selection for the three target schools, or the acquisition of a degree. In Tunisia, admission to, and selection for, public higher education institutions is based on baccalaureate grades, and there is no discrimination based on gender or origin in this process. In fact, the proportion of female students exceeds that of male students at all three target schools. In the survey of teachers, it was confirmed that there were no difficulties in teaching classes or supervising graduation theses at the three target schools due to reasons related to the gender or origin of the students.

On the other hand, two cases of harassment were confirmed. The first case was reported by a student, and involved a female student from Monastir, a coastal city in central-eastern of Tunisia who had difficulty integrating into the class and who was teased by her classmates, both male and female, for reasons including the way she spoke and the way she dressed. The second case was reported by a teacher and involved a professor who harassed a particular female student by following her home. After the student reported the incident to the school, the professor was punished by the school, and eventually dismissed[29].

Based on the above, judging from a comprehensive perspective, it can be said that there has been no inequality in the treatment of students on the basis of gender or home region/locality in the three target schools in terms of admission, the educational environment or degree attainment. There has been equal access to science education for male and female students.

(4) Marginalized People

Not applicable.

(5) Social Systems and Norms, People's Well-being and Human Rights

Not applicable.

[29] In addition to the above, there was also a case reported in which a student (male) who was caught cheating by a professor was verbally abusive and physically attacked the professor. However, this case cannot be linked to gender issues.

(6) Unintended Positive / Negative Impacts

ISTIC is working with the University of Aizu to implement the JICA Grassroots Technical Cooperation Project "Project Model Development for ICT Start-up Human Resources Development for Youth and Women" (cooperation period 2023-2025). In this grassroots technical cooperation project, faculty members from ISTIC and the University of Aizu visit each school in turn every year to provide training for students. ENSTAb is supported by the German Academic Exchange Service (DAAD) and is conducting a joint research project with the Institute of Technology of Inglostadt in Germany on e-mobility, e-energy and electric vehicles in the Bavarian region. CBBC was involved in two SATREPS projects with Tsukuba University and other organizations and obtained six patents through SATREPS (the patent rights are shared between Tsukuba University and CBBC).

In summary, the quantitative effects (operation and effect indicators) were mostly achieved, as targets for the number of students, the number of degree recipients, and the number of teachers were all achieved except for ISSTE. The qualitative effects, such as the development of human resources in science and technology, the improvement of R&D capacity and the creation of a foundation for the promotion of R&D in Tunisia, were recognized as having been achieved as planned. In addition, a positive impact on efficient R&D through industry-government-academia collaboration was also recognized, although the impact on strengthening the international competitiveness of science, technology and industry in the medium to long term was limited. There was no negative impact on the natural environment due to this project, and there was no resettlement of people associated with the land acquisition. With regard to gender equality, the proportion of female students and researchers at the target schools and research centers is high, and it was confirmed that women are given sufficient opportunities for education and participation in R&D in the science and technology.

In the light of above, this project has mostly achieved its objectives. Therefore, the effectiveness and impacts of the project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Policy and System

As mentioned in "3.1.1 Consistency with the Development Plan of Tunisia", *Tunisia's Vision 2035*, which was formulated at the time of the ex-post evaluation, includes measures to strengthen skills, promote R&D, digital transition, and innovation. In addition, the *Strategic Plan for the Reform of Higher Education and Scientific Research 2015-2025* aims to (i) increase employment opportunities for students by improving the quality of university education; (ii) identify education and priority fields that meet the needs of society; (iii) strengthen the

partnership between the socio-economic community and universities by strengthening the role of Technoparks and interface mechanisms; (iv) create added value and increase productivity by promoting joint projects between research organizations and companies, and the involvement of companies in R&D activities; and (v) promote the creation of spin-off companies and innovative companies through the utilization and practical application of research outputs. Therefore, the policies and systems in place are designed to continue the effects achieved through this project.

3.4.2 Institutional/Organizational Aspect

The operation and maintenance (O&M) of the facilities and equipment of the target three higher education institutions and target four research centers is the responsibility of each school and research center. The O&M of research equipment is the responsibility of the technicians at each school and research center, but is mainly outsourced to private maintenance service providers (mainly the local agents of equipment manufacturers) for preventive maintenance, repairs, and the replacement of spare parts.

In addition to budgeting and allocating O&M costs for the target higher education institutions and research centers, MESRS also provides support for the purchase of spare parts and the procurement of private maintenance service providers as necessary. The O&M of the common facilities of the three target schools, including the university residence for students, the university restaurant and sports facilities, is handled by the University Works Office of the Northern Region under MESRS. The University Works Office is responsible for the O&M of university-related facilities (university residence for students, restaurant, cultural and sports facilities) as well as for student loans throughout Tunisia, and has three offices nationwide, with the Northern Region Office managing the facilities for this project. The Northern Region Office is responsible for 70 facilities in 11 governorates in northern Tunisia, and has 3,000 staff, 42 of whom are in charge of the facilities for this project.

The MESRS oversees more than 100 universities and research centers nationwide, but due to the problems of administrating a large number of facilities with a limited number of staff, it has begun to introduce a new system that transfers authority to specific universities and research institutions and provides them with the necessary budget, allowing them to operate and maintain their facilities autonomously and at their own discretion (some universities and research centers in Borj Cedria Technopark are also included).

Therefore, no issues are observed in the institutional/organizational aspect.

3.4.3 Technical Aspect

The three target schools and the four target research centers have formulated annual O&M plans for their equipment, and also provide regular training for staff in charge of O&M. In

addition, although manufacturers provide O&M training when equipment is installed, the training period is short, and there are also cases where staff in charge of O&M transfer or leave the school, so there is a high need for continuous technical training from the manufacturers. There are also issues such as the insufficient technical skills of private maintenance service providers in Tunisia who are in charge of the O&M of research equipment, and a shortage of qualified personnel[30].

MESRS regularly organizes training programs on the O&M of buildings, facilities and equipment, and the participants in these training programs then provide training to the staff responsible for the O&M of each school and research center.

Although there are some issues with the O&M of research equipment at the three target schools and four target research centers, the staff in charge of O&M are responding to these issues with their own ingenuity, and the main research equipment is generally kept in good condition and is used in daily education and research activities.

3.4.4 Financial Aspect

The O&M costs for the facilities and equipment of the three target schools and the four target research centers are basically allocated by MESRS each year, but, with the exception of CBBC, it is recognized that the current maintenance budget is insufficient. The four target research centers have established a technology transfer platform that conducts joint research with, and inspection and analysis services for companies, and are promoting collaboration with companies. It is possible to earn service fees from inspection and analysis services commissioned from companies, and a portion of this is allowed to be used for O&M costs[31]. On the other hand, under current law, employees of public institutions such as research centers are prohibited from having a second job, so they cannot pay a portion of the revenue generated by the platform to staff (researchers, technicians, etc.) who have been commissioned to work on the services as a work allowance, and this may become an obstacle to the expansion of the platform's functions and activities in the future[32]. In relation to this issue, MESRS is reviewing the relevant regulations (Decree on Share of Revenue) so that a portion of the revenue generated from platform activities can be distributed as a work allowance to staff. According to MESRS, the revised decree was expected to be approved by the Chamber of Deputies (the Lower House) and enacted by the end of 2024.

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[30] Compared to the engineers of the manufacturers of project equipment, engineers of local agents in Tunisia are assessed as being somewhat inferior in terms of knowledge and technical skills. As a result, it takes time to repair equipment, and there are also cases where it is difficult to fix the problems.

[31] Generally, 40% of the revenue from commissioned inspection and analysis services is used for consumables, 30% for overheads, and 30% for staff costs.

[32] Because work on the platform is additional to the primary duty and work, it is apparently difficult to pay the necessary work allowances for the work. Thus there will be no incentive for staff to work on the platform, even if each research center tries to expand the activities of the platform as a profit-making business.

3.4.5 Environmental and Social Aspect

The three target schools and four research centers properly store and dispose of hazardous waste in compliance with laws and regulations, and no particular environmental and social risks are recognized.

3.4.6 Preventative Measures to Risks

ISSTE has seen a decline in the number of students since 2017. This has been well recognized by ISSTE, and in order to take advantage of its specialities and characteristics, the school has developed programs in collaboration with industry, developed international projects, and organized seminars, conferences, and open days to share research with academia and industry and raise the visibility of the university. In order to halt the decline in the number of students at ISSTE and to turn this into an increase in the future, efforts to differentiate ISSTE from other universities and increase its comparative advantage as an institution of higher education in environmental sciences should be continued.

3.4.7 Status of Operation and Maintenance

Major research equipment at the three target higher education institutions and four research centers is generally maintained in good condition.

Although slight issues have been observed in the technical and financial aspects, and preventative measures to risks, there are good prospects for improvement/resolution. Therefore, sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to foster science and technology-related human resources and improve R&D capacities by supporting the higher education and R&D functions of the Borj Cedria Science and Technology Park near Tunis, thereby contributing to human resource development to strengthen the country's industrial competitiveness. The project was consistent with the development plan and development needs of Tunisia at the time of the appraisal and at the time of the ex-post evaluation. Consistency with Japan's assistance policy was also confirmed. There was also more-than-expected collaboration with other JICA projects, as well as with Japanese universities such as Tsukuba University. Therefore, the relevance and coherence of the project are very high. Although there were some revisions to the project scope and additional outputs, the outputs were generally implemented as planned. Although the project cost was within the plan, the project period significantly exceeded the plan. Therefore, the efficiency of the project

is moderately low. Regarding the quantitative effect (the operational and effect indicator), the targets were mostly achieved except for the number of students, the number of students who obtained degrees and the number of teachers of some higher education institutions. As regards the development of human resources in science and technology, the improvement of R&D capacity and the creation of a foundation for the promotion of R&D in Tunisia, effects have been observed as planned. A positive impact on efficient R&D through industry-government-academia collaboration was also recognized, however, the impact on strengthening the international competitiveness of science, technology and industry in the medium to long term was limited. No negative impacts on the natural environment caused by the project were identified, and there was no resettlement associated with the land acquisition. The high proportion of women among students at the target higher education institutions and researchers at the research centers confirms that women are given adequate opportunities to participate in science education and R&D. From the above, it can be concluded that the project has mostly achieved its objectives. Therefore, the effectiveness and impacts of the project are high. Slight issues have been observed in the technical and financial aspects, and preventative measures to risks, however, there are good prospects for improvement/resolution. Therefore, the sustainability of the project effects is high.

In light of the above, this project is evaluated to be highly satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

(1) ISSTE's efforts to restore student numbers

In order to halt the decline and recover the number of students, it is suggested that ISSTE make efforts such as: (i) developing specialized educational and research programs in collaboration with research centers in the Borj Cedria Technopark, (ii) developing practical environment-related educational programs to meet the needs of industry in collaboration with companies, and (iii) providing support for students' job hunting by networking with industry and providing opportunities for students to interact with industry, etc. The school should differentiate itself from other higher education institutions and provide high value-added higher education that takes advantage of its strengths and characteristics. The MESRS is also expected to provide ISSTE with the technical, institutional, and financial support necessary for the above efforts.

(2) Strengthening the financial base by expanding the functionality of the research centers' technology transfer platform and self-management of intellectual property rights

The four target research centers have established a technology transfer platform within the center, are actively promoting joint research with socio-economic partners (government, universities, associations, companies, NGOs, etc.) and are commissioning work related to the testing and analysis of products. The activities conducted through this platform are close to social

implementation, such as the development and practical application of new products and services that utilize the knowledge and technologies of industry, and this is also a valuable opportunity to obtain patents. At the same time, revenues generated from platform activities can be used as a financial resource for R&D activities at each research center and for the O&M of facilities and equipment. Based on the above, the following recommendations are made:

- That the MESRS continue to provide the necessary support and monitoring with the aim of amending the relevant regulations (Decree on Share of Revenue) by the end of 2024 to enable the provision of work allowances to platform staff.
- Currently, the MESRS and the National Institute for Standardization and Industrial Property (INNORPI[33]), handle the application procedures and management of patents for each research center. It is proposed to MESRS that institutional changes and the necessary technical assistance be considered so that, in the future, the above-mentioned functions of MESRS and INNORPI can be transferred to each research center, enabling each center to file and manage its own patents. This will not only further raise researchers' awareness of the value and use of intellectual property rights, but it is also expected to increase the revenue of each research center through patent royalties. In order to achieve this, it would be a good idea to create a system with functions similar to a joint platform that integrates the platforms of the four research centers in the Technopark, and to consolidate the work involved in patent applications, management, use, etc. on this platform. Alternatively, it is also possible to give the Management Company of the Technopole de Borj Cedria similar functions.
- That each research center continue to actively promote joint research with socio-economic partners and commissioned work related to testing and analysis, and to make further efforts to turn the research outputs into startups and commercialization. To achieve this, it is hoped that MESRS, in collaboration with the technology valorization and transfer unit/platform of the target research centers, will actively create opportunities to share information on the research achievements and research personnel of each research center in the Technopark, the research equipment they have, and what kind of analysis, testing and services they can provide; and conduct public relations activities with socio-economic partners, and holding exhibitions, symposiums and other events on a regular basis.

4.2.2 Recommendations to JICA

It is necessary that JICA continue monitoring of the progress of construction on some minor works not yet completed in this project such as fire detection system facility work at ISTIC,

[33] INNORPI: Institut National de la Normalisation et de la Propriété Industrielle.

piping work at ENSTAb, and work for shared service facilities in the research and innovation zone.

4.3 Lessons Learned

(1) The need for support to improve skills from a long-term perspective

One of the main objectives of this project was to improve R&D capabilities in the three priority fields of Tunisia: biotechnology, water resources and the environment, and renewable energy. To this end, both tangible and intangible support was provided. In terms of tangible support, this included the construction of research center facilities and the provision of research equipment, while in terms of intangible support, this included scholarship programs in Japan in the three fields mentioned above. In addition, technical cooperation projects and the dispatch of experts implemented in parallel with this project also provided support for the promotion of R&D activities. In addition, joint research was conducted between Tsukuba University and other universities in Tunisia, including CBBC, under the SATREPS framework, for 10 years from 2010 to 2021, and technology transfer was carried out to make effective use of the research equipment introduced to CBBC through this project. In this way, by making use of various JICA cooperation schemes, support for the gradual and continuous improvement of R&D capabilities was provided, and this is making a significant contribution to the improvement of the capabilities of the research centers concerned. Generally, it takes a certain period of time before the results of capacity improvement become apparent, so it is important to provide continuous support from a long-term perspective.

(2) The need to dispatch experts to provide procurement support

In this project, there were several unsuccessful bids due to unsuccessful contractor bids and budget overruns, and the procurement package was revised. These were some of the main factors in the delay of the project. There were also external factors, such as changes in the implementation structure within the Tunisian government. Other issues were also identified such as (i) the Ministry of Equipment and Housing was responsible for the centralized management of public works procurement in Tunisia, and while authority was concentrated in this ministry, it was also short of staff due to the large number of projects it was handling, and (ii) the procurement of research equipment requires a high level of expertise and knowledge in the relevant research field, but the staff involved in preparing the specifications for each piece of equipment and the tender documents did not necessarily have sufficient expertise and knowledge. The above issues may also have been among the factors that delayed the tendering process. Later, the procurement system of the Tunisian government was reviewed, and JICA also provided assistance for procurement by the Special Assistance for Project Implementation (SAPI) and the dispatch of experts. In cases where consulting services do not include assistance for procurement, as in this

project, it is important that JICA dispatch procurement support experts and provide the necessary technical assistance to the implementing agency or procurement agency, taking into account the government procurement system and implementation system/capacity of the respective country, also monitoring the progress of the procurement process for a project on a regular basis.

5. Non-Score Criteria

5.1 Performance

5.1.1 Objective Perspective

In this project, the implementing agency changed in 2007 from a two-ministry system (Ministry of Science, Technology and Skill Development and Ministry of Higher Education) to the Ministry of Higher Education and Scientific Research (MESRS) due to the merger of the two ministries. The project coordination unit also changed from the Borj Cedria Technopark Special Purpose Unit under the Ministry of Science, Technology and Skill Development to the Directorate General for Promotion of Research, MESRS. This means that there was a change in the project implementation structure. In addition, the project was delayed due to several unsuccessful bids and budget overruns, as well as the need to review the procurement package. Furthermore, the Jasmine Revolution in Tunisia, which began on December 18, 2010, led to political and economic turmoil that continued for several years. During this time, there was a significant turnover of government officials, including those at organizations involved in the project, and this also affected the progress of the project.

In response to these changes in circumstances that were not initially anticipated, JICA continued to carry out regular monitoring (quarterly/monthly), attend quarterly project monitoring committee meetings, conduct on-site inspections, etc., and provided support for construction work, the procurement of research equipment and consultants, and support for the formulation of a techno-park development strategy, etc., through the implementation of SAPI and the dispatch of experts. In addition to this, the project also implemented technical cooperation projects and dispatched individual experts to help acquire knowledge of intellectual property rights and support R&D in the three priority fields (renewable energy, biotechnology, water and the environment). Furthermore, in collaboration with Tsukuba University, JICA implemented SATREPS and successfully obtained six patents through joint research with other universities in Tunisia, including the CBBC.

According to MESRS, JICA was very cooperative and flexible in dealing with the various issues and difficulties that arose during the project implementation period, and played an important role in the project's implementation.

5.1.2 Subjective Perspective (retrospective)

[Objective of Detailed Analysis]

In this detailed analysis, interviews were conducted with people involved in Japanese universities, including the Alliance for Research on the Mediterranean and North Africa (ARENA), Tsukuba University, Tunisian government agencies and other related organizations involved in JICA-related projects, including the implementing agency of this project, together with Tunisian researchers who obtained PhDs from Japanese universities. The details of the collaboration and support provided by Japanese universities, the details of the interventions by JICA-related projects, and their outcomes, as well as the relationships between the outcomes, are organized and analyzed based on the interviews. An examination is then made of how collaboration with JICA-related projects, Tsukuba University, Tokyo University of Agriculture and Technology, etc. has led to the creation of intellectual property by higher education, R&D, and patents in Tunisia. Based on these analyses, lessons that can be used as a reference for forming and implementing similar cooperation are derived.

[Results of Analysis]

In 2001, Tsukuba University concluded an academic exchange agreement with the University of Carthage, and in 2004 established the Tsukuba University Center for North African Studies (current the Tsukuba University Tunis Office) in Tunis, thus establishing a base for academic exchange in Tunisia. With this background, Tsukuba University was involved in the conception and formation of this project from project formulation stage, in collaboration with the Japan Bank for International Cooperation (currently JICA). In terms of direct involvement in this project by Tsukuba University, the university played a leading role in the scholarship program, matching Tunisian students with Japanese universities, accepting Tunisian students in Japan (Tsukuba University accepted 15 of the 29 students), and providing research guidance to the students. In addition, in the “Project on the Management of Technopark in Borj Cedria” (2006-2009), which was implemented in parallel with this project, Tsukuba University acted as a team leader and provided support for (i) improving understanding of the management system (particularly knowledge of intellectual property) on the part of Technopark management staff, and (ii) promoting the activities of research institutions in the Technopark. Of the three target research fields covered by this project, Tsukuba University has mainly given support to the field of biotechnology, and has implemented two SATREPS projects (i.e. “Valorization of Bio-resources in Semi-Arid and Arid Land for Regional Development” (2010-2015) and “Project for Valorization of Bioresources in Semi- and Arid Land Based on Scientific Evidence for Creation of New Industry” (2016-2021)) with Tunisian universities, including CBBC, as counterparts. In this SATREPS project, joint research was conducted using the research equipment introduced to CBBC through this project, and technology transfer was carried out to ensure the effective

use of the research equipment. Furthermore, as the Japanese host of the Tunisia-Japan Symposium on Science, Society and Technology (TJASSST[34]), Tsukuba University has shared and exchanged the results of research with Tunisian industry, government and academia, including MESRS and the target research center of this project, for over 20 years, and has contributed to international academic exchange between Tunisia and Japan.

The diagram in the appendix (Figure 3: Changes through a series of cooperation using the Theory of Change (TOC)) shows the flow of how this project, related JICA support and the cooperative relationships with Tsukuba University have led to the strengthening of Tunisia's international competitiveness in science, technology and industry. Alongside the implementation of this project, JICA experts were dispatched, and technical cooperation projects and the Special Assistance for Project Implementation (SAPI) were conducted. These JICA interventions consisted of support relating to the content of this project as well as support focusing on specific issues such as the trouble shooting of obstructive factors affecting project progress such as procurement issues, etc. The results of each type of JICA supports, while differing in level, have led to improvements in the R&D capabilities of the research center and researchers in the Technopark, industry-academia collaboration, and patent registration.

5.1.3 Other spillover project effects

In this project, there was active collaboration with related JICA technical cooperation projects, and in particular, a new food ingredient called "HIF1STEM" was developed that activates stem cells using an extract from the leaves of a North African variety of olive, which was discovered during the research process of the SATREPS project. This led to a social implementation, such as commercialization by a private company that participated in the SATREPS project. This project is thought to have made a certain contribution to the realization of social implementation brought about by SATREPS through the strengthening of capabilities of the research centers at the Borj Cedria Technopark.

(End)

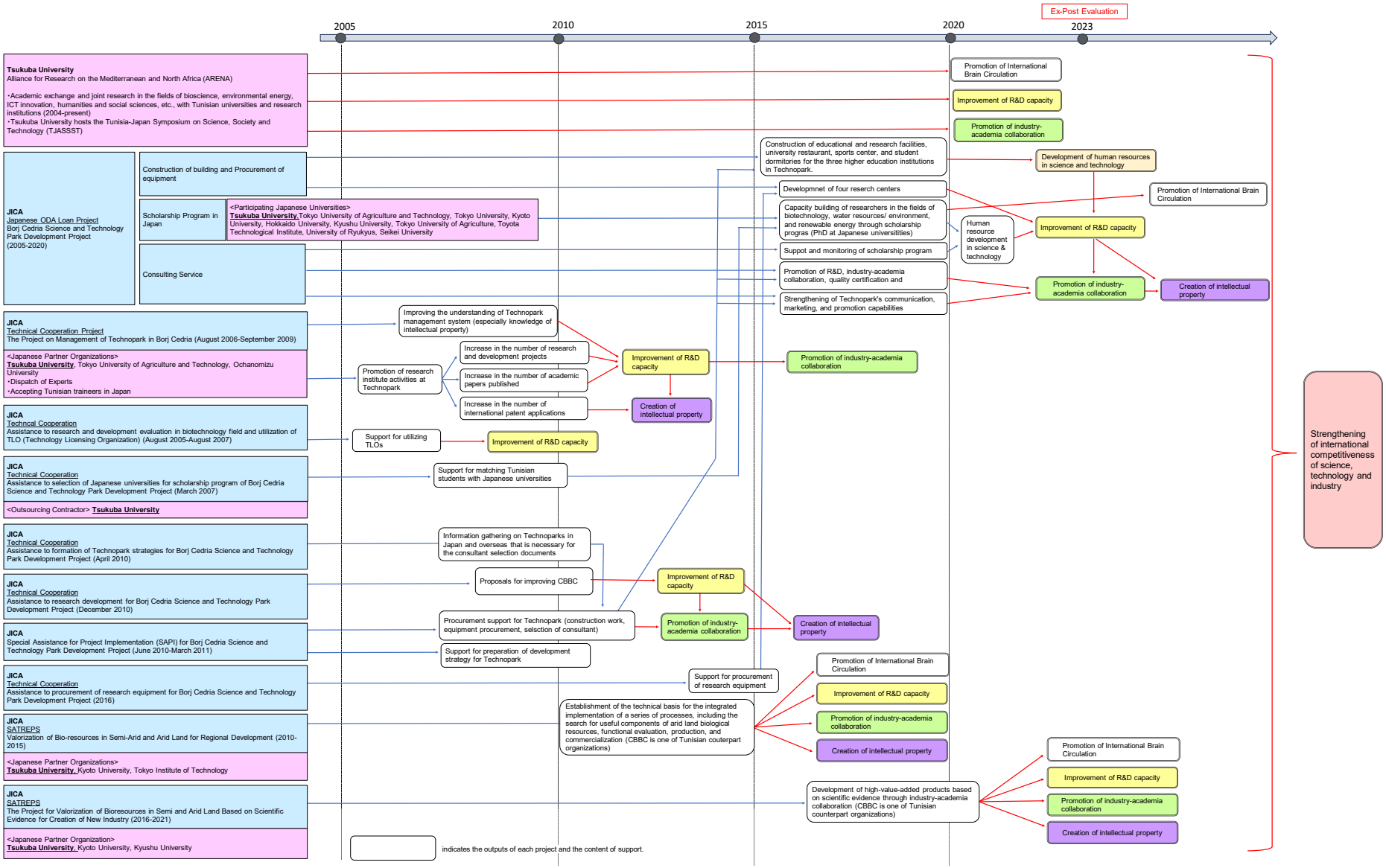
[34] TJASSST is an interdisciplinary international symposium established in 2000, covering a wide range of research fields, including food, medicine, agriculture, materials, energy, water, the environment, and social sciences. TJASSST is a unique event where researchers, experts, and decision-makers from Tunisia and Japan exchange their experiences in various research fields. TIJAST has been held every two years.

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs (a) Construction and Procurement of Equipment [University Zone]	• Procurement of equipment for Higher Institute of Environmental Science and Technology (ISSTE) • Construction of facility and procurement of equipment for Higher Institute of Information and Communication Technology (ISTIC) • Construction of facility and procurement of equipment for Higher Institute of Technology (ISET) • Construction and equipment procurement for university restaurant (commonly used by 3 schools) • Construction and equipment procurement for sport center (commonly used by 3 schools)	• Same as planned • Same as planned (except unfinished work for fire detection system facility) • ISET was changed to National School of Advanced Science and Technology (ENSTAb): Same as planned for construction of facility and procurement of equipment (except unfinished part of piping work) • Same as planned • Same as planned • Construction of facility and procurement of equipment for an university residence for female students with 600 beds (Additional scope)
[Research and Innovation Zone]	• Procurement of research equipment for National Institute for Scientific and Technological Research (INRST) • Construction of facility and procurement of equipment for shared service facilities (meeting rooms, canteens, spaces for banks and shops, etc.), attached facilities (business support service centers), and central library	• Same as panned (INRST was reorganized into three research centers: Energy Research and Technology Center (CRTEn), Water Resources Research and Technology Center (CERTE), and Biotechnology Research Center (CBBC). These three research centers were constructed by the Tunisian government's own funds.) • The shared service facilities at Technopark were integrated with the attached facilities, and the scale was greatly reduced. The shared facility has been under construction. • New construction of administration and research building and procurement of equipment for National Center for Material Science Research (CNRSM) (Additional scope)
(b) Scholarship Program	• Support for obtaining a doctorate at Japanese universities (training and capacity development of researchers engaged in research in the fields of biotechnology, water resources and the environment, and renewable energy)	• Same as planned • 29 Tunisian students obtained PhDs from Japanese universities
(c) Consulting Service	• Overall project monitoring, assistance for loan disbursement and preparation of reports • Formulation of development strategy and operation/management plan of Technopark • Formulation of development strategy for utilization of research outputs including management of intellectual property rights, and promotion of collaboration between research institutes, universities and companies • Monitoring of scholarship students in Japan • Input: International consultant: 83M/M; Tunisian consultant: 264M/M	• Same as planned • Same as planned • Same as planned • Same as planned • Input: International consultant: 129.9MM; Tunisian consultant: 336.7MM
2. Project Period	June 2005-September 2011 (76 months)	June 2005-March 2020 (178 months)

Item	Plan	Actual
3. Project Cost Amount Paid in Foreign Currency Amount Paid in Local Currency Total ODA Loan Portion Exchange Rate	 4,271 million yen 6,675 million yen (77 million dinar) 10,946 million yen 8,209 million yen 1 dinar = 86.2 yen (As of November 2001)	 N.A. N.A. (N.A.) 8,207 million yen 4,994 million yen 1 dinar = 56.45 yen (Average between 2005 and 2020)
4. Final Disbursement	December 2018	

<Appendix> Figure 3 Changes through a Series of Cooperation using the Theory of Change (TOC)



Source: prepared by Evaluator.